Page 1 *Overview*

The assessment of sports-related concussions has evolved considerably. In the past, the focus was on retrospective grading and the length of time to resolution of the injury. Now, licensed health care professionals should base their diagnosis and management decisions on an assessment that incorporates not only the subjective report of the patient but also the results of more objective tests and measures. It is important to remember that *assessment* is not a single test, but the integration of multiple sources of information.

The assessment of concussions is a practice in development and continues to evolve. Gaps in our understanding still remain. But studies of real life athletes have opened vast new insights into the nature of concussions and more effective strategies for treatment, and as research expands, we'll know more.

Assessment Progress

Video

KODY MOFFATT, MD, MS, Children's Hospital & Medical Center, Director of Pediatric Sports Medicine
I will tell you as doctors we have learned more about teenagers and concussions in the last two or three years than we have learned in the last twenty or thirty. Really, signs and symptoms are still the mainstay of our diagnosis and initial management.

LORI TERRYBERRY-SPOHR, PhD, ABPP, Madonna Rehabilitation Hospital, Director of Rehabilitation Programs
We also want to be looking at other factors like cognitive recovery, things like memory, processing speed, attention, clinical efficiency, or cognitive efficiency.

KODY MOFFATT
There are other non-cognitive assessments other than symptoms alone that can really make a difference.

RUSTY McKUNE, ATC, Nebraska Medicine, Sports Medicine Program Coordinator
We also are starting to look more at balance, the vestibular, the visual tracking.

KODY MOFFATT
And evaluating how young people are doing in school as well as out of school.

RUSTY McKUNE
We can't assign a grade to the concussion at the time of the injury. We want to take more of a retrospective look at how long does it take for those athletes or those patients to feel normal again.

KODY MOFFATT
If computerized testing is used, especially in a group environment, and doing a pre-season baseline test for instance . . .

RUSTY McKUNE
They really need to make sure that they're trained in the utilization of these tests. So that not only the tests are performed correctly, but they're also interpreted correctly.

KODY MOFFATT
It's often easier to do in a school setting where you utilize a computer lab and test multiple kids at the same time. However, it's also been shown that children perform differently in a group setting in a mass environment than they do in a quiet individualized setting as well. And those can certainly affect your outcomes.

RUSTY McKUNE
It can't be overstated that this cannot be an isolated test. It's got to be something that is used in conjunction with your clinical finding, with the comprehensive evaluation process. And it can't be something that is a standalone measure to determine when it's safe for someone to Return to Play.

LORI TERRYBERRY-SPOHR
CT scans and MRI scans are clinically useful from the perspective that they rule out bleeds and the need for urgent intervention. But they don't help us much with the diagnosis of concussion.

KODY MOFFATT
For non-research purposes right now, we still don't have a good scan for concussions. By definition, if someone has a concussion, their CT or MRI will be normal.

RUSTY McKUNE
Concussions are a functional disturbance. They're not a structural injury.

LORI TERRYBERRY-SPOHR
Concussion occurs at the cellular level and the balance of calcium and potassium in the cells gets very disrupted, and it occurs over the period of several hours to several days, but won't show up on any type of measure like a CT or a MRI scan.

KODY MOFFATT
CT scanning is best used if you're trying to rule out bleeding on or within the brain. MRIs are best used if you're trying to rule out a structural defect.

RUSTY McKUNE
The assessment process really is the ability to take everything that we know about the injury, take everything that we find in the history, put it all together, and come up with that diagnosis.

LORI TERRYBERRY-SPOHR
And what you'll find is the more you do of it, the more comfortable you become. It becomes much clearer what you're looking for in terms of kind of tell-tale signs like the pattern of the head aches, the pattern of the symptom presentation, what might be more reflective of a concussion versus what you might be linking to some historical patterns with that patient. It's just like anything else you that assess, you get better the more you see of it.

KODY MOFFATT
We still don't have a good, what I call "pregnancy test" that says either you have a concussion or you don't have a concussion. It's really more art than science.

RUSTY McKUNE
There still is not that one golden arrow that we can utilize to nail down that definitive diagnosis. It has to be a comprehensive overview and compilation of what we see during our clinical assessment.

Testing is not concussion management, but it is one piece. Successful management and treatment of concussion rely on a thorough clinical assessment, which includes multiple factors. After initial diagnosis, the licensed health care professional can determine whether or not to send the patient on to experts for advanced testing appropriate to the case.

* *

Page 2 ***Diagnosis***

For collegiate athletes, the National Collegiate Athletic Association (NCAA) prefers initial diagnosis as soon after the event as possible, with **clinical assessment** within 48 to 72 hours. The challenging reality is that in many cases, the young person will show up more than 72 hours after the event, not feeling well but not aware of having suffered a concussion.

Right now, there are well-researched assessment tools that are science-based. Other tools are a result of consensus of best practice. It falls to the licensed health care professional to look at the reliability and validity of potential assessment tools, and from that determine which to use and when to use them. It's essential for the licensed health care professional to pull together the data from multiple sources to properly assess the patient, because there is no one perfect assessment tool: there is no "pregnancy test" for concussion that provides a yes-or-no answer.

Diagnosis is the first stage of assessment. The patient has to meet the criteria for the definition of a concussion in order for a licensed health care professional to make a clinical decision based on the presentation of symptoms after a known or presumed mechanism of injury. (See Module 2 of this course to review the criteria for concussion.)

Injury Account *Get a detailed description of what exactly happened at the point of injury.*	**Symptom Course** *Review the physical, emotional, cognitive, & sleep symptoms from **Module 3** and note their severity.*
• What events led to the injury? • What is the mechanism of the injury? • Was there loss of consciousness? • Did you experience any amnesia? • What are the exact symptoms you experienced at the time of the injury?	▯ How have you been feeling? ▯ Do you feel like yourself? ▯ How is your mood? ▯ What have you been doing since your injury? ▯ Which of the symptoms you had at the time of the injury are you still experiencing? ▯ Are any of the symptoms resolving? ▯ Are any getting worse? ▯ What symptoms appeared *after* the injury? ▯ Are any of those symptoms getting worse? ▯ Are you having headaches? ▯ Are you able to fall asleep easily and stay asleep all night? ***If a parent or guardian is present, ask the adult the same questions.***

Remember: **diagnostic assessment** is a beginning. At this stage, it is helpful to carry out a brief neurologic assessment including vision tracking, coordination, neck pain, and balance, as well as a brief cognitive status assessment. The **SCAT5** is a useful tool for this type of diagnostic assessment. ▯

Child-SCAT5TM, for children ages 5 to 12.
http://bjsm.bmj.com/content/47/5/263.full.pdf+html?sid=046984fe-3314-4a60-9a6f-2365e4793517

- **SCAT-5TM** for ages 13 and up. http://bjsm.bmj.com/content/47/5/259.full.pdf+html?sid=9d1895fa-fb5a-4ebe-9211-eb716fccca50 Other diagnostic tools include:
- **Graded Symptom Checklist** (on Resources page in this course).
- **ACE Physician / Clinician Office Version.** http://www.cdc.gov/headsup/pdfs/providers/ace-a.pdf

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Page 3 *Clinical Assessment*

Getting a Good History

Video

KODY MOFFATT, MD, MS, Children's Hospital & Medical Center, Director of Pediatric Sports Medicine
A detailed history is critical in concussion management.

LORI TERRYBERRY-SPOHR, PhD, ABPP, Madonna Rehabilitation Hospital, Director of Rehabilitation Programs
Particularly when meeting with the patient for the first time.

RUSTY McKUNE, ATC, Nebraska Medicine, Sports Medicine Program Coordinator
It tells us the story of the injury.

LORI TERRYBERRY-SPOHR
You want to be able to differentially diagnose concussion from other things like anxiety, depression, migraines, other neurological symptoms and syndromes.

KODY MOFFATT
First of all, a concussion is a traumatic brain injury, meaning you have to have trauma. So, if somebody has dizziness, headache, and other symptoms, and there's no trauma, this is not a concussion.

RUSTY McKUNE
A thorough history really gives us a chance to compare that individual prior to the injury to that individual at the time of the assessment.

KODY MOFFATT
What happened to cause the injury as well as what happened immediately before and after the injury are all critical factors.

RUSTY McKUNE
It allows us to identify what things are typical for that individual.

KODY MOFFATT
And if someone has preexisting conditions, such as migraine headaches or other neurocognitive problems, then expect those to be magnified afterwards.

LORI TERRYBERRY-SPOHR
So having that information is key in helping to determine what's leading to the current symptom presentation.

Clinical History *Look for modifiers:* *pre-morbidities and co-morbidities.*
▯ Do you have any pre-existing conditions such as depression, anxiety, learning disability, migraines, ADHD, headaches, substance abuse, encephalitis, epilepsy, etc.? Have you ever had brain surgery? ▯ Have you had past head injuries? What happened, and how long did it take to recover? ▯ Have you had any prior episodes of any of the symptoms you're having now?

Whenever possible, the licensed health care professional should compare the patient's baseline performance with post-injury performance. Consulting with family, friends, and school sources can help fill in this part of the clinical picture.

It's important to get a good history, because there may be a strong relationship between previous issues and concussion symptoms. Note that some previous symptoms (pre-morbidities) may now be more exaggerated, and recovery may be variable. There may be more symptoms that last longer. (Comorbidities will be discussed in greater detail later in this course.)

* *

Page 4 *Neurologic Assessment*

Neurologic assessment typically involves a head-to-toe exam with components such as:
- Visual examinations, including pupil size and reactivity (PEARL), nystagmus, smooth pursuit, and funduscopic examination.
- Manual muscle test from head to toe, noting whether it exacerbates symptoms.
- Balance, including heel-to-toe and gait.

Focal neurologic findings will point to other diagnoses.

To Scan or Not to Scan
Neuro-imaging *will not* provide a solid "This is a concussion" diagnosis, but *is* useful in ruling out structural abnormalities when indicated. Along with concerns about structural abnormalities in an acute exam, other red flags for neuro-imaging include focal neurologic deficits and/or an atypical course — for example, a sudden increase in symptoms for no reason.

This statement from the American Society for Sports Medicine can equip you with facts to counter any arguments from concerned family members or other lay people who may question the decision to forego neuro-imaging.

From the
2013 American Medical Society for Sports Medicine Position Statement:
Concussion in Sport
http://bjsm.bmj.com/content/47/5/250.full

"The vast majority of athletes with sports-related concussion do not require neuroimaging. Standard neuroimaging with computed tomography (CT) or magnetic resonance imaging (MRI) is negative in concussion, but is used to evaluate for more serious brain injury."

CT (Computed Tomography)	**MRI (Magnetic Resonance Imaging)**
Best used acutely for evaluating for: • Bony fractures. • Intracranial bleeding, contusion, mass effects. (narrator reads "and/or") • Brain stem herniation. CTs expose the brain to radiation and should be used judiciously.	More sensitive for: • Evaluating persistent or worsening symptoms. • Concern for underlying pathology (e.g., headache or seizure disorder, arteriovenous malformation, Chiari malformation, etc.). MRIs have improved with stronger magnets and different techniques that can detect minor abnormalities after concussion. The clinical relevance of the findings are unclear.

* *

Page 5 *Cognitive Assessment*

A cognitive assessment should measure and evaluate these items:
- Orientation, attention and concentration, and memory.
- Processing speed.
- Executive functioning: the ability to plan and organize.

Simple questions can prompt revelations that will help you assess your patient's judgment, planning, and ability to get things done.

You can learn a great deal just from questioning the patient, deriving information from what the young person says, how he or she says it, and how family members or friends present react to the responses.

For example, a parent present during an exam will probably be delivering non-verbal cues as the young person speaks, affirming or discounting the accuracy of statements.

Possible Questions to Use in Objective Clinical Assessments

QUESTION	PURPOSE
Tell me what's going well in school.	Keep questions open-ended. Start with positives.
How are you doing in school overall? *How are you struggling?* *What are you struggling with?* *How is math going?* *How about a foreign language?* *How are your studies in literature?* *What is happening in art class?*	If there are differences in responses to each course, that may give you hints as to where the trouble lies.
Have any of your grades changed since your injury happened? *Which subjects have changed?*	Identify the changes that may be due to the injury.
Have you taken tests? How *did you do?*	Inability to concentrate undermines performance.
How is homework going in the evening?	Answers to this question will help you assess concentration, focus, and fatigue.
How is your sleep?	Determine whether the patient is sleeping more or less than normal.
Are you getting your homework done on time? *Are you able to organize your work?*	Answers to these questions will help you assess executive functioning and planning.

This process should be effective in the vast majority of cases you will see. If a case is more complicated, it's recommended you seek out a specialist. We'll give suggestions in Module 6.

* *

Page 6 ***Assessment Tools Summary***

Here are tools a licensed health care professional may use to help assess an mTBI, and tools that should be used only by an expert.

Who	Use	Tool	Description
Licensed Health Care Professional	**Standard clinic assessment tools**	• SCAT5™ • Child-SCAT5™ • Graded Symptom Inventory • ACE Physician	Initial diagnostic information about vision, coordination, neck pain, balance, and cognitive status.
Athletic Trainer	**Sideline***	• SCAT5	Not specific diagnosis, but indication of trouble, including neurocognitive deficits.

*When you need to refer the patient to an **expert**, here are some of the tested assessment tools that an **expert** may use.*	**Balance and vestibular**	• SOT (Sensory Organization Test). • Bess. • Force Plates. • C3 Logix balance app • Modified Romberg.	Identification of specific balance or vestibular symptoms.
	Visual	• Saccadic Eye Movement. • Dynamic Visual Acuity. • Smooth Pursuit. • Pupillometry.	Identification of specific visual symptoms.
	Neurologic Status	Cranial Nerve Assessment.	Tests nerve function through stimulation, movements.
		Upper and Lower Quarter Neurologic Evaluation.	Confirms normal neurologic status through strength, sensory, and reflex testing.
	Neurocognitive Deficits	• ImPACT • ANAM • HeadMinder • Cogstate	Computerized test results
		Pencil & paper Neuropsychological Testing CNS Vital signs	Assessment from neuropsychologist.

* Physician assessment in the sideline often involves a limited set of items with removal to the locker-room or quiet environment for complete SCAT assessment if sideline screening indicates the need. These procedures are usually sanctioned by a governing body. Absent appropriate medical professionals, State laws require removing athletes from play until proper assessment can be completed if a concussion is suspected.